

Vietnam's energy transition to 2050: is importing liquefied natural gas a good solution?

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ABSTRACT

Energy and the environment are among the biggest challenges facing humanity in the 21st century. The issue of the energy transition has become increasingly important as countries around the world seek to shift towards cleaner, more sustainable forms of energy. For a rapidly developing economy like Vietnam, the energy challenge becomes even more urgent. A reasonable energy transition strategy will be an important prerequisite for sustainable economic development, national security, environmental improvement and climate change mitigation. One potential solution that has been proposed is to increase imports of liquefied natural gas (LNG) to help meet Vietnam's energy needs while reducing its reliance on coal. In this article, the author analyses the potential for Vietnam to import LNG in the future.

1. INTRODUCTION

Humanity is facing great challenges from climate change, the warming of the Earth's surface and its interconnected systems. The main cause of these phenomena is the excessive use of energy by humans, especially from fossil fuels such as coal and oil. However, whether we want it or not, humans cannot avoid using energy as it is an essential factor in all human activities. Current efforts are aimed at reducing or stopping the consumption of traditional fossil fuels and developing clean, renewable energy sources, which is an inevitable trend in the world today.

In today's context, natural gas is an energy source that can replace coal and petroleum in many fields and is considered an intermediate bridge energy source in the transition from traditional energy to renewable energy.¹ Natural gas is considered the cleanest fossil energy source because when burned, it only emits about half the amount of carbon dioxide (CO₂) compared to coal and 3/4 compared to petroleum, and the amount of nitrogen oxides emitted is also very low compared to coal and petroleum, and there is almost no sulphur dioxide, particulate matter or mercury (EIA, 1998). That is why the demand for natural gas has increased rapidly over many decades, and natural gas is used in many ways and in many different fields, especially to replace coal in electricity production to reduce greenhouse gas emissions and environmental pollution.

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¹ IEA, 'World Energy Outlook - Are We Entering a Golden Age of Gas?' (2011); Steffen Jenner and Alberto J Lamadrid, 'Shale Gas vs. Coal: Policy Implications from Environmental Impact Comparisons of Shale Gas, Conventional Gas, and Coal on Air, Water, and Land in the United States' (2013) 53 Energy Policy 442; MIT, *The Future of Natural Gas* (MIT study 2010).

All scenarios and reports on energy from most organizations and energy companies around the world have forecasts of a very significant increase in natural gas demand in the coming decades and have positive outlooks on the long-term future of natural gas such as the International Energy Agency (IEA), the World Energy Council (WEC), and energy companies such as Shell and ExxonMobil. The IEA even stated that natural gas is entering a golden age.² Indeed, in most scenarios presented by these organizations, natural gas will be the largest source of energy in the world by 2050. In particular, the Asia region will be the main driving force behind the growth in natural gas consumption in the future. In IEA's scenarios, the growth rate of natural gas demand in this region is very high, from 3.6 per cent to 4.3 per cent per year compared to 1.4–1.7% per year at the global level,³ and even 5.1 per cent per year according to the forecast results of the Prospective Outlook on Long-term Energy Systems (POLES) model.⁴

According to some studies, by 2050, the demand for gas in the Asia region could account for approximately 48–57 per cent of the global gas demand, with the majority of natural gas serving electricity needs.⁵ Asia will increasingly rely on imported gas, especially liquefied natural gas (LNG). According to some scenarios, by 2050, the total amount of natural gas imported by the Asia region could account for about 70 per cent of the global gas trade, with Asia's LNG imports alone accounting for over 80 per cent of the total global LNG trade level.⁶

Vietnam is one of the fastest developing economies in Southeast Asia, with a population of over 98 million and an energy market that is one of the largest in the region. According to statistics from the General Statistics Office, the primary energy supply of Vietnam is estimated to be around 96.22 million tonnes of oil equivalent (TOE), with the final energy consumption at 66.39 million TOE.⁷ Vietnam's strong economic growth is based on a highly energy-intensive economy, with fossil fuels being the primary source of energy. The demand for electricity in Vietnam is increasing rapidly. However, Vietnam's electricity still heavily relies on fossil fuels, with coal dominating the country's electricity production.⁸

According to a report from the United Nations Educational, Scientific and Cultural Organization (UNESCO), Vietnam is ranked among the countries with a high and very high level of impacts from climate change. Coping with climate change is a major challenge for Vietnam. Vietnam has been a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) since 1994 and committed to participating in activities to combat climate change according to the resolutions of the United Nations General Assembly on climate change. Particularly at global climate change summits (COP), especially COP 21 and COP 26 held in Paris and Glasgow, the Prime Minister of Vietnam has demonstrated strong commitments to reduce greenhouse gas emissions. The commitment of the Vietnamese government is to reduce greenhouse gas emissions by 9 per cent in 2030 compared to the business as usual (BAU) scenario with the country's efforts, and by 27 per cent with additional support from the international community.⁹

Therefore, in order to implement a sustainable energy development strategy that meets the needs of economic development, national security, environmental protection and climate change mitigation, Vietnam needs policies related to the energy transition, including the choice of developing natural gas.

² IEA, 'World Energy Outlook - Are We Entering a Golden Age of Gas?' (n 1).

³ IEA, 'World Energy Outlook 2015' (2015); IEA, *World Energy Outlook 2016* (OECD/IEA 2016); IEA, *World Energy Outlook 2017* (OECD Publishing 2017) <<http://public.eblib.com/choice/publicfullrecord.aspx?p=5160837>> accessed 22 March 2019; Minh Thong Le and others, 'Can Natural Gas Play an Important Role in the Energy Transition in Asia in the Future?' (2019) 7 *Eurasian Journal of Business and Management* 28.

⁴ Minh Thong Le, 'The Development of Natural Gas in Asia—the Results of the Forecast Scenarios of the POLES Model' (2022) 15 *The Journal of World Energy Law & Business* 409.

⁵ Le and others (n 3); Le (n 4).

⁶ IEA, 'World Energy Outlook 2015' (n 3); IEA, *World Energy Outlook 2016* (n 3); IEA, *World Energy Outlook 2017* (n 3); Le (n 4).

⁷ General Statistics Office, 'Statistical Yearbook 2020' (2020).

⁸ Quang Minh Tran, 'Projection of Fossil Fuel Demands in Vietnam to 2050 and Climate Change Implications' (2019) 6 *Asia & the Pacific Policy Studies* 208; Shigeru Kimura and Han Phoumin, *Energy Outlook and Energy Saving Potential in East Asia 2019* (2019) <<http://www.eria.org/publications/energy-outlook-and-energy-saving-potential-in-east-asia-2019/>> accessed 24 April 2020.

⁹ Vietnam's NDC, 'Nationally Determined Contribution' (2022) <https://unfccc.int/sites/default/files/NDC/2022-11/Viet%20Nam_NDC_2022_Eng.pdf> accessed 20 March 2023.

2. VIETNAM'S ENERGY DEVELOPMENT ORIENTATION

Vietnam's energy development orientation is aimed at ensuring national energy security, reducing greenhouse gas emissions, and promoting sustainable economic growth. The country has set a target of increasing the share of renewable energy in the total primary energy supply to 15–20 per cent by 2030 and 25–30 per cent by 2045.¹⁰ At the same time, Vietnam will continue to exploit its domestic fossil fuel resources, including coal, oil and natural gas, to meet its growing energy demand. However, the government is also seeking to diversify its energy mix by importing LNG.

Resolution No. 55-NQ/TW issued by Politburo on 11 February 2020, provides a clear direction for the national energy development strategy of Vietnam until 2030 and a vision towards 2045. It also identifies the weaknesses and limitations in the development of energy in Vietnam in the past, as well as the causes of those shortcomings. The resolution also outlines the viewpoints and orientations for energy development in the upcoming period.^{11,12}

The point of view

Ensuring secure national energy security is the foundation and an important prerequisite for the development of the economy and society. Prioritizing the development of fast and sustainable energy, taking a step ahead, coupled with the protection of the ecological environment, ensuring national defence and security, and implementing social progress and justice is of special importance and a central task throughout the process of industrialization and modernization of the country.

Developing the national energy sector must be in line with the socialist-oriented market economic system and the trend of international integration; quickly building a synchronized, competitive, transparent, diversified energy market with various forms of ownership and business methods; applying market prices to all types of energy. Encouraging and creating favourable conditions for economic actors, especially private businesses, to participate in energy development; resolutely eliminating all manifestations of subsidies, monopolies, unfair competition and lack of transparency in the energy sector.

Developing synchronized, rational and diversified forms of energy; prioritizing the exploitation, utilization and efficiency of renewable energy sources, new energy, and clean energy; rational use of fossil energy sources in the country, with a focus on stabilizing, regulating and meeting national energy reserves; prioritizing the development of gas power, with a reasonable roadmap for reducing the proportion of coal-fired power; proactively importing fuel from abroad for power plants. Optimizing the national energy system allocation in all areas based on the comparative advantages of each region and locality.

Emphasis should be placed on researching and applying the achievements of the Fourth Industrial Revolution in the development of all energy sectors and fields; promoting digital transformation in the energy industry; gradually mastering modern technologies and moving towards self-reliance in the production of the majority of energy equipment.

Using energy efficiently, effectively and protecting the environment must be seen as an important policy and responsibility of the entire society. Strengthening energy audits; building a synchronized mechanism and policies with strong and feasible sanctions to encourage investment and use of energy-saving technologies and equipment, environmentally friendly, contributing to promoting labour productivity and renewing growth models.

Directional objectives

Providing sufficient energy supply domestically to meet the targets of the 10-year Socio-Economic Development Strategy from 2021 to 2030; in which primary energy by 2030 will reach around

¹⁰ Nguyen Van Binh, *Vietnam's National Energy Development Strategy Orientation to 2030, vision to 2045* (National Economics University Publishing House 2020).

¹¹ Resolution No 55-NQ/TW, 'Politburo's Resolution 55-NQ/TW on the Orientation of the Viet Nam's National Energy Development Strategy to 2030 and outlook to 2045' <<https://tulieuvankien.dangcongsan.vn/he-thong-van-ban/van-ban-cua-dang/nghi-quyet-so-55-nqtw-ngay-11022020-cua-bo-chinh-tri-ve-dinh-huong-chien-luoc-phat-trien-nang-luong-quoc-gia-cua-viet-nam-den-6096>> accessed 9 February 2023.

¹² *ibid.*

175–195 million TOE (tons of oil equivalent) and by 2045 will reach around 320–350 million TOE; the total capacity of power sources by 2030 will reach about 125–130 GW, with an electricity output of about 550–600 billion kWh.

The proportion of renewable energy sources in the total primary energy supply is expected to reach about 15–20 per cent by 2030 and 25–30 per cent by 2045.

The total final energy consumption is projected to reach 105–115 million TOE by 2030 and 160–190 million TOE by 2045.

The energy savings rate in the total final energy consumption compared to the normal development scenario is expected to reach about 7 per cent in 2030 and about 14 per cent in 2045.

The reduction in greenhouse gas emissions from energy activities compared to the normal development scenario is expected to be 15 per cent in 2030 and 20 per cent in 2045.

3. VIETNAM'S ENERGY POTENTIAL AND DEMAND

The potential of Vietnam's energy sources

In general, Vietnam has a lot of potential in terms of energy. However, there are still many issues in developing energy sources in the national energy structure. Traditional fossil energy sources such as coal, oil and hydropower will soon reach their exploitation limit. Currently, Vietnam has had to import coal, and will soon import LNG to ensure energy demand. However, renewable energy sources have considerable potential, especially wind and solar power.

Hydroelectricity

Vietnam has the potential to exploit a capacity of about 25,000–38,000 MW for hydropower, of which 60 per cent is concentrated in the North, 27 per cent in the Central region, and the remaining 13 per cent in the South. More than 1000 potential sites have been discovered nationwide for small hydropower projects, ranging from 30–100 MW, with a total capacity of over 7000 MW. To date, Vietnam has built 19.7 GW of medium and large hydropower, and it is expected to build an additional 1.8 GW from 2020 to 2025. For small hydropower, it is estimated that about 2.5 GW can be built. Vietnam has exploited almost all of its large hydropower potential and is now mainly focused on developing small hydropower. However, Vietnam's hydropower development potential is nearly exhausted.¹³

Natural gas

Overall, Vietnam has the potential for gas exploration with an annual output of around 10 billion cubic meters. Vietnam is actively seeking to explore and develop new gas fields to meet future demand, particularly for gas-fired power plants. Currently, Vietnam's 2P gas reserves (relatively certain reserves) are estimated to be around 432 billion cubic meters, of which approximately 150 billion cubic meters have been extracted. However, according to many assessments, Vietnam will have to import LNG in the future to meet its gas demand. Vietnam's natural gas imports in the future will mainly come from Australia, Qatar, Russia, the USA and Middle Eastern countries.¹⁴

Coal

Vietnam's total coal reserves are estimated at about 2.2 billion tons, mainly located in the Northeast basin, which can be exploited for about 40 years at the current mining rate. According

¹³ Dang Dinh Thong, 'Hydropower Development in Vietnam: Potentials and Challenges' [2017] Năng lượng Việt Nam Online <<https://nangluongvietnam.vn/phan-trien-thuy-dien-o-viet-nam-tiem-nang-va-thach-thuc-19934.html>> accessed 20 March 2023; Vietnam Energy Magazine, 'Update on Vietnam's Gas Reserves and Potential' (Online, August 2020) <<https://nangluongvietnam.vn/cap-nhat-ve-tru-luong-tiem-nang-khi-dot-cua-viet-nam-24932.html>> accessed 9 February 2023.

¹⁴ Vietnam Energy Magazine, 'The Remaining Oil and Gas Potential of Vietnam is not much and it is Difficult to Deploy' (Online, 2023) <<https://nangluongvietnam.vn/tiem-nang-dau-khi-con-lai-cua-viet-nam-khong-nhieu-va-rat-kho-trien-khai-30144.html>> accessed 20 March 2023.

to calculations, the production of commercial coal will reach about 53–54.8 million tons in the period of 2030–2035. Besides supplying for electricity production, coal also provides for households and industrial consumption. Based on projections, in the medium and long term, domestic coal will only supply 35–40 million tons/year for electricity, which is enough for the current 14,000 MW of coal-fired power plants.¹⁵ Meanwhile, new power plants under construction have to use blended coal or imported coal. Therefore, Vietnam will have to increase coal imports from Indonesia, Australia, South Africa and Russia.

Oil

According to many research reports, Vietnam has potential in oil and gas reserves. With a total area of about 1.3 million km², including the continental shelf, geological surveying using geophysical methods has identified seven prospective basins containing oil and gas reserves: the Cuu Long Basin, Nam Con Son Basin, Song Hong Basin, Malay-Tho Chu Basin, Phu Khanh Basin, Hoang Sa Basin and Truong Sa Basin, which are divided into 108 oil and gas blocks with a total area of about 491,570 km². Results from exploration and drilling activities have estimated Vietnam's total oil reserves at around 4 billion barrels, of which 60 per cent have been identified. However, most of the large oil fields have already been discovered, and the remaining fields are small, marginal and located far offshore, making extraction more difficult.¹⁶

Renewable energy

About wind power: Vietnam has great potential for wind power development thanks to its over 3000 km-long coastline and mountainous areas in the North and Central regions. According to a World Bank study, over 39 per cent of Vietnam's area has an average wind speed of over 6 m/s at a height of 65 m, equivalent to a total capacity of 512 GW. In addition, about 8 per cent of the land area has an annual average wind speed of over 7 m/s, equivalent to a total capacity of 110 GW. Another study has shown that 8.6 per cent of Vietnam's territory has the potential for developing large-scale wind power plants, ranging from 'good' to 'very good'.¹⁷

Regarding solar energy: Vietnam is one of the countries with great potential for solar energy. The potential for solar energy in Vietnam is equivalent to countries such as Italy, Spain and California or to neighbouring countries such as China and Thailand. The potential for solar energy can be exploited based on solar radiation. Vietnam is an area with relatively high and stable hours of sunshine and solar radiation intensity annually. The average number of hours of sunshine in the North ranges from 1500 to 1700 hours/year, while the Central and Southern regions have higher average hours of sunshine, from 2000 to 2600 h/year. According to the results of research and technical potential analysis of the Vietnam Energy Institute, the total available area is very large, accounting for nearly 14 per cent of the total area of the country, with available technical potential of up to 1677.5 GW.¹⁸

¹⁵ Vietnam Energy Magazine, 'Update on Vietnam's Gas Reserves and Potential' (n 13); Department of Geology of Vietnam, 'Introduction to Vietnam's Mineral Potential' <<http://www.dgmv.gov.vn/bai-viet/gioi-thieu-ve-tiem-nang-khoang-san-viet-nam>> accessed 20 March 2023.

¹⁶ Vietnam Energy Magazine, 'Update on Vietnam's Gas Reserves and Potential' (n 13); Vietnam Energy Magazine, 'The Remaining Oil and Gas Potential' (n 14).

¹⁷ Tran Tuan Anh, 'About Vietnam's National Energy Development Strategy to 2025, Orientation to 2035' [2018] *Tap chí Công sản* <<http://www.tapchiconsan.org.vn/home/nghiencuu-traodoi/2018/53329/ve-chien-luoc-phat-trien-nang-luong-quoc-gia-cua-viet-nam.aspx>> accessed 19 April 2019; World Bank, 'Wind Energy Resource Atlas of Southeast Asia' (The World Bank 2001) 31870 <<http://documents.worldbank.org/curated/en/252541468770659342/Wind-energy-resource-atlas-of-Southeast-Asia>> accessed 4 May 2020; Duc Luong Nguyen, 'A Brief Overview on Assessments of Wind Energy Resource Potential in Vietnam' [2014] *J Fundam Renewable Energy Appl*; EREA and others, 'Viet Nam Technology Catalogue - Technology Data Input for Power System Modelling in Viet Nam' <<https://zenodo.org/record/2859959>> accessed 26 April 2020.

¹⁸ AECID and MOIT, 'Maps of Solar Resource and Potential in Viet Nam' (2014); J Polo and others, 'Solar Resources and Power Potential Mapping in Vietnam Using Satellite-Derived and GIS-Based Information' (2015) 98 *Energy Conversion and Management* 348; Nguyen Anh Tuan, 'Assessment of Solar Energy Potential for Electricity Generation in Vietnam' (2018); Vietnam Institute of Energy, 'Draft National Electricity Development Planning Scheme for the Period of 2021-2030, with a Vision to 2045' (2021) <<http://www.erea.gov.vn/d6/vi-VN/news/Bo-Cong-Thuong-xin-y-kien-gop-y-Du-thao-De-an-Quy-hoach-phat-trien-dien-luc-quoc-gia-thoi-ky-2021-2030-tam-nhin-toi-nam-2045-23-2303-108>> accessed 10 February 2023.

Other renewable energy sources

Besides wind and solar energy, according to the study of Vietnam Institute of Energy, Vietnam also has great potential in other forms of renewable energy such as biomass energy, solid waste energy, geothermal energy. . . .¹⁹

Biomass energy: As an agricultural country, Vietnam has a lot of potential for developing biomass energy. Some common types of biomass include wood, crop residues, agricultural waste, urban waste and other organic waste. Biomass energy can be used by direct combustion or by converting it into biomass fuels. The total theoretical potential of biomass electricity in Vietnam is around 13.7 GW. However, in terms of economic and technical feasibility, it is estimated that we can build around 5 GW of this electricity source in the future.

Solid waste energy: On average, nearly 35,000 tons of urban solid waste and 34,000 tons of rural solid waste are discharged daily. In big cities like Hanoi and Ho Chi Minh City, there are 7000–8000 tons of waste every day. The technical potential of this energy source is around 1.55 GW. The amount of waste is currently being wasted due to not being fully utilized for energy production.

Geothermal energy: Vietnam has over 250 hot springs distributed throughout the country, including 43 hot springs ($>61^{\circ}\text{C}$). Of the total 164 geothermal sources in the northern central and mountainous regions of Vietnam, up to 18 sources have surface temperatures $>53^{\circ}\text{C}$, which can be used for electricity production. The geothermal potential across Vietnam is estimated at around 300 MW.

Tidal energy: In Vietnam, the potential for tidal energy is not significant and can only reach a capacity of 4 GW in coastal areas of the Mekong River Delta. However, we are currently in the stage of researching the potential for developing this energy source, so many areas with a great potential need to be studied in the near future.

Vietnam's energy demand and energy transition trends

According to recent forecasts, the demand for energy in Vietnam will continue to increase and could reach a growth rate of 8 per cent per year from now until 2035.²⁰ According to estimates from the national energy development strategy, primary energy demand in the future will be around 100–110 million TOE in 2020, 110–120 million TOE in 2025, and 310–320 million TOE in 2050. The General Statistics Office of Vietnam estimates that electricity demand will continue to increase at an annual growth rate of 10–12 per cent in recent years, rising from 169.8 terawatt hours (TWh) in 2015 to 615.2 TWh in 2030. According to a 2016 report by Enerdata, Vietnam will have the largest increase in primary energy demand, followed by China and India, with 78 per cent in the period 2015–2040. In a report by the Asian Development Bank, Vietnam's primary energy demand is expected to increase from 67.7 Mtoe in 2010 to 186.0 Mtoe in 2035, with an annual growth rate of 4.1 per cent. Vietnam's final energy demand will continue to increase at an annual rate of 3.3 per cent until 2035.

The continuous increase in energy demand has not only made Vietnam one of the countries most affected by climate change but also posed a significant challenge to ensuring Vietnam's energy security in the future. The trend of shifting from traditional fossil energy sources to clean energy sources is inevitable. In addition to solutions for clean energy development such as natural gas and renewable energy, the production of hydrogen and the development of carbon capture, utilization and storage technologies (CCUS) are also crucial solutions for protecting the environment and mitigating the impact of current climate change worldwide. These are the issues that many scientists and countries around the world are concerned about and researching. However, the production and utilization of hydrogen, as well as the capture, storage and utilization of carbon, require advanced technology and techniques, along with financial resources and a high-quality workforce. Additionally, they require a strategic development plan, as well as a supportive legal framework. In Vietnam, issues related to hydrogen production and the development of carbon

¹⁹ Vietnam Institute of Energy (n 18).

²⁰ Danish Energy Agency, 'Vietnam Energy Outlook Report 2019' (2019).

capture, storage and utilization technologies are also expected to be important solutions in the country's energy transition roadmap to fulfil its commitments at COP26. Numerous seminars and workshops have been organized by government agencies and organizations in Vietnam, involving scientists and energy research institutions both domestically and internationally. In Vietnam, the national oil and gas corporation (PVN) has made initial proposals for the development of hydrogen production technology and carbon capture and utilization based on the existing infrastructure, workforce and financial resources of the company, aiming to take a pioneering role in the development of these technologies. However, in Vietnam, these are still relatively new issues that require a process of knowledge acquisition, technical expertise, technology adoption, workforce development and financial resources to be able to deploy and implement them effectively.

So that, in the current context, when it is not possible to immediately convert from traditional energy sources to renewable energy sources, or the use of modern technologies to produce clean fuels such as hydrogen and carbon capture, utilization and storage technologies to reduce the impact of climate change cannot yet be implemented; natural gas—with good characteristics compared to traditional energy sources, is considered an important bridge in the world's energy transition to a low-carbon economy and Vietnam also.

4. CURRENT STATUS OF THE NATURAL GAS MARKET AND POTENTIAL FOR THE DEVELOPMENT OF LNG IN VIETNAM

Actual situation of exploitation and use of natural gas in Vietnam

The natural gas industry in Vietnam has developed and grown closely linked with the formation and development of the oil and gas industry in Vietnam in particular and the country's development stages in general. From the discovery of the *Tiền Hải* gas field in the Hanoi Basin on 18 March 1975 to the discovery and exploitation of oil and gas fields in the Cuu Long and Nam Con Son Basins, it laid the foundation for the development of the oil and gas industry in Vietnam in general, and the natural gas industry in particular.

According to collected data, Vietnam's natural gas potential is estimated at around 871 billion cubic meters, with a relatively certain reserve of about 432 billion cubic meters. To date, Vietnam has extracted about 150 billion cubic meters, according to statistics from the Vietnamese Energy Magazine in 2020.²¹ The majority of domestic natural gas production comes from gas fields, accounting for 64.8 per cent, with associated gas accounting for the remaining 35.2 per cent. The total annual natural gas production of Vietnam is about 10 billion cubic meters per year. All of Vietnam's extracted natural gas is used for domestic consumption, mostly for gas-fired power plants.²²

According to forecasts, the demand for natural gas in Vietnam will continue to increase in the coming years, especially for use in electricity production to offset the power capacity from coal-fired power plants and reduce greenhouse gas emissions in line with commitments made at COP 21 and 26. Therefore, in the future, Vietnam will need to expand exploration and exploitation activities to provide additional reserves and production in potential, deep offshore areas; develop the gas industry; prioritize investment in technical infrastructure to facilitate imports and consumption of LNG.²³

So it can be seen that Vietnam's natural gas production is relatively low and not enough to meet future demand, especially in the electricity production sector. Recognizing the importance of developing the LNG market in Vietnam, the Party and the Government have assigned relevant departments to research the planning and development of this energy source and have issued some related policy guidelines such as Decision No. 60/QĐ-TTg dated 16 January 2017,

²¹ Vietnam Energy Magazine, 'Update on Vietnam's Gas Reserves and Potential' (n 13).

²² Nguyen Manh Hung, 'Orientation for Sustainable Development of Vietnam's Gas Industry' [2019] *Tap chí Năng lượng Việt Nam* <<https://nangluongvietnam.vn/dinh-huong-phat-trien-ben-vung-nganh-cong-nghiep-khi-viet-nam-22853.html>> accessed 9 February 2023.

²³ Tran Tuan Anh (n 17).

approving the development plan for Vietnam's gas industry until 2025 with a vision towards 2035; and especially Resolution No. 55-NQ/TW dated 11 February 2020, by the Politburo on the strategic orientation for the development of Vietnam's energy sector until 2030, with a vision towards 2045. The development objectives for Vietnam's gas industry in the near future are to focus on developing the gas industry, prioritize the development of gas-fired power plants, invest in technical infrastructure to serve LNG import and consumption and ensure the capacity to import about 8 billion m3 of LNG by 2030 and about 15 billion m3 by 2045. According to the new development orientation, Vietnam will gradually reduce its reliance on coal-fired power plants and increase the proportion of gas-fired power, aiming to reach 23 per cent by 2030 and 25 per cent by 2045 (Resolution No 55-NQ/TW, 2020).

The Vietnamese Government has approved a plan to build LNG storage and regasification ports to prepare for the reception of imported LNG sources, according to Decision No. 60/QĐ-TTg dated 16 January 2017, approving the development plan for Vietnam's gas industry until 2025, with a vision to 2035. The plan includes: an LNG port warehouse in Cat Hai—Hai Phong with an expected capacity of 1.8 million tons/year, to meet the demand in the northern region, expected to be operational by 2030; an LNG port warehouse in Van Phong—Khanh Hoa with a port capacity of 3.0 million tons/year to ensure supply for the central region, expected to be operational by 2030; a Thị Vải LNG port warehouse in Ba Ria—Vung Tau with a total capacity of 3 million tons in two warehouses, which can be expanded to 6 million tons/year to compensate for the reduced supply in the southeast region and to supply gas to the expanded Nhon Trach 3, Nhon Trach 4, Phu My 3 and expanded Hiep Phuoc power plants, expected to be operational from 2020 to 2023; an So'n Mỹ LNG import port warehouse in Binh Thuan province to supply gas to the Son My power centre and the southeastern region, with an expected total capacity of up to 10 tons/year; and the Hon Khoai/FSRU Southwestern LNG port warehouse with a capacity ranging from 2.0 to 3.3 million tons/year, expected to be operational by 2023 (Decision No 60/QĐ-TTg, 2017). In addition, there are some proposed projects to supplement the plan and floating storage and regasification units (FSRUs), such as the Hai Linh LNG warehouse at the Cai Mep Industrial Park, the FSRU in Bac Lieu and the FSRU in Thai Binh.

Potential development of liquefied natural gas in Vietnam

Policy support

The Vietnamese government and Communist Party recognize the importance of developing LNG in the context of energy development to ensure economic growth, national security and environmental protection against climate change. This is evidenced through various documents and policies related to the development of the LNG market in Vietnam, such as Decision 60/QĐ-TTg approved by the Prime Minister on 16 January 2017, which outlines the development plan for the Vietnamese gas industry until 2025 and towards 2035, with a clear focus on international cooperation, LNG imports, integration with gas markets in the region and the world, and the establishment of infrastructure to receive and import LNG at each stage. Additionally, Resolution 55-NQ/TW approved by the Politburo on 11 February 2020, regarding the National Energy Development Strategy of Vietnam until 2030 with a vision towards 2045, prioritizes investment in technical infrastructure for LNG import and consumption and emphasizes the rapid development of LNG thermal power plants, making LNG power a significant energy source to support the system's regulation.

In addition, the recent Draft of the 8th Electricity Development Plan also shows a great interest in developing LNG power to reduce dependence on coal-fired power plants. The Draft sets a target of converting 18 GW of coal-fired electricity into 14 GW of LNG power by 2030. This means that by 2030, there will be 23,900 MW of LNG power developed, equivalent to over 16 per cent of the electricity source structure, mainly concentrated in the northern region to ensure electricity supply for this area.²⁴

²⁴ Vietnam Institute of Energy (n 18).

The increase in global gas trade

Global LNG trade has developed rapidly in recent decades. In 2000, the global LNG trading volume was only over 140 Gm³, and by 2021, it had increased to over 516 Gm³, equivalent to 50 per cent of the total natural gas trading.²⁵ With its advantages, LNG is playing an increasingly important role in the global natural gas trade. Currently, major LNG exporters include Australia, the USA, Russia, Qatar, Malaysia and Nigeria. In terms of LNG imports, Asian countries are the largest LNG importers in the world. The amount of LNG imported into Asia accounts for over 70 per cent of the total global LNG trading, mainly focusing on countries such as Japan, South Korea, Taiwan and the rapid growth of China, India and Southeast Asian countries. According to many forecasts, Asia is still the driving force behind the growth of global LNG demand. This is driven by a strong policy implementation to shift from coal to gas, as well as economic growth.²⁶

To meet the global demand for LNG import and export, the capacity of liquefaction plants continues to increase in recent years. Many LNG exporting countries have invested in building LNG plants to increase their export capacity, led by Australia and the USA. The USA has become the world's second-largest exporter of LNG with a total volume of 86.1 MTPA, behind Australia with 87.6 MTPA and ahead of Qatar with 77.1 MTPA. According to estimates, there is currently about 875 MTPA of proposed investment capacity in the next growth phase starting from 2020.²⁷ This has created a highly competitive environment and generated a large supply to meet the increasing demand for LNG in the future. This is both an opportunity and a challenge for the development of LNG in Vietnam. Vietnam will have many opportunities to access LNG suppliers, but Vietnam will also face fierce competition from other countries in the Asia region.

The increase and displacement of gas supply in different regions of the world

Prior to 2015, when climate change and the energy transition were not yet given proper attention, and the shale gas revolution had not yet developed strongly, the US remained the world's largest importer of natural gas. The majority of the imports still came from Middle Eastern and African countries.²⁸

However, when the shale gas revolution, especially in the USA, occurred strongly, the global LNG trade flow has undergone many changes. Natural gas, which was once considered depleted, has now become an abundant source of energy. This has created many changes for natural gas markets in regions and countries. The development of the natural gas market worldwide, especially the LNG market in recent times, has made commercialization between gas markets worldwide very developed, diversifying natural gas supply sources in the global natural gas market.²⁹ For example, the USA, which used to import a lot of LNG to meet its demand, has gradually become a major LNG exporter in the world. Accordingly, previous LNG suppliers for the North American market are gradually shifting to find new customers, mainly in the Asia-Pacific region. According to the 2021 IGU report, the largest LNG trade flow in the world is still in the Asia-Pacific region. This trend is unlikely to change in the short term due to high demand growth in China, Southeast Asia and South Asia and increased supply from Australia, which is also an advantage for Asian countries including Vietnam in accessing LNG supply sources.³⁰

²⁵ IUG, 'Global Gas Report 2022' (2022) <<https://www.igu.org/resources/global-gas-report-2022/>> accessed 9 February 2023.

²⁶ MIT (n 1); Howard V Rogers, *Asian LNG Demand: Key Drivers and Outlook* (the Oxford Institute for Energy Studies, 2016); Minh Thong Le, 'The Development of Natural Gas in Asia—the Results of the Forecast Scenarios of the POLES Model' (2022) 15 *The Journal of World Energy Law & Business* 409.

²⁷ IUG, 'World LNG Report 2022' (2022) <<https://www.igu.org/resources/world-lng-report-2022/>> accessed 9 February 2023.

²⁸ Le Minh Thong and Tran Van Hiep, 'Advantages and Disadvantages of the Development of Liquefied Natural Gas in Vietnam Today' [2023] *Asia-Pacific Economic Review*.

²⁹ James Henderson, *The Potential Impact of North American LNG Exports* (Oxford Institute for Energy Studies 2012); Roberto F Aguilera, Julian Inchauspe and Ronald D Ripple, 'The Asia Pacific Natural Gas Market: Large Enough for All?' (2014) 65 *Energy Policy* 1.

³⁰ Le Minh Thong, Tran Van Hiep and Nguyen Thanh Thuy, 'Developing the Liquefied Natural Gas Market in Vietnam' [2023] *Economy & Forecast Review*.

Barriers to LNG development in Vietnam

The legal framework has not been synchronized/completed

In reality, LNG projects require complex technology and equipment, and construction and operation demand large investment capital and are still very new to Vietnam. Although the Politburo and the Government have issued specific directions and plans for the development of liquefied natural gas and have issued some relevant policy documents, the legal framework system is still incomplete, such as the lack of a legal framework on mechanisms and policies for the gas market, lack of planning for connecting LNG ports with industrial zones, lack of management mechanisms for LNG power investment projects of large scale to facilitate capital arrangements, and the need to establish mechanisms and policies for the electricity price of using LNG fuel to ensure the development of LNG power plants.³¹ This is also the reason why all LNG port projects in Vietnam under the current plan are implemented slowly.

Import competition with other countries

According to various forecast scenarios, Asia remains the driving force behind the increase in global LNG demand mainly due to the strong implementation of policies to shift from coal to gas and economic growth. Important markets driving global LNG growth include China, Japan, South Korea, India and Pakistan. In addition, the increase in Australia's production capacity also makes the regional gas trade more vibrant.

Furthermore, recent developments in the world, such as the Russia–Ukraine conflict, have caused significant changes in the global energy market, including the LNG market, with unpredictable outcomes. Import policies for LNG have also changed, leading to fierce competition among LNG supply sources, especially in countries within the European Union. Therefore, Vietnam's LNG imports will also face competition from other countries.

Fluctuations in gas prices and LNG freight rates

The price of imported LNG plays a crucial role in developing the domestic natural gas market, ensuring the competitiveness of LNG against other energy sources. However, in reality, the price of imported LNG will depend on many factors such as supply and demand, transportation costs, contract forms, and price mechanisms applied. Currently, the price of imported LNG from other countries is affected by factors such as the price of gas in the export market, liquefaction costs, transportation costs and gasification costs. Therefore, when these factors change, the price of imported LNG will fluctuate accordingly.

The price of LNG varies according to the fluctuations of the global oil price. Before 2014, when oil prices soared to \$90/barrel, the price of LNG also increased to \$17–18/MMBtu. In April 2020, when oil prices plummeted to a record low of under \$20/barrel due to the Covid-19 pandemic, the price of LNG also dropped below \$2/MMBtu. According to Enerdata, the forecasted LNG prices from now until 2040 in the three market regions of Europe, Asia, and North America all have a tendency to rise, with LNG in the Asian region having the highest price due to large transportation distances and high demand.³²

The fluctuation of shipping rates for LNG also greatly affects the imported LNG prices in Vietnam and impacts the calculations of LNG import investors. For example, in the early 2010s, the growth rate of LNG transportation fleets was well balanced with the additional liquefaction capacity put into operation, leading to a stable ship leasing market. However, the delivery speed of ships exceeded the growth rate of liquefaction capacity from 2013 onwards, resulting in excess LNG transportation capacity and a gradual decline in ship leasing rates. This decline continued until 2015, after which LNG ship leasing rates remained in the range of \$15,000/day to \$50,000/day until the end of 2017 when the rapid increase in Asia's LNG demand led to a rise in leasing rates.

³¹ Thong and Van Hiep (n 28).

³² Enerdata, 'Energy Outlook for Power and Gas in Asia – Focus on Risk Assessment' (2016).

It is noteworthy that at the end of 2018, there was an unprecedented surge in leasing rates with daily leasing rates reaching \$190,000 in most of November³³

5. CONCLUSION

The changes in the global gas market in recent years have had a significant impact on the gas market in Asia, including Vietnam, increasing the supply to this region, including the development of conventional gas, the shift to LNG export markets of other countries, and changing gas prices. Therefore, it can be seen that Vietnam has many opportunities to develop the LNG market as this is also a trend of energy transition that many countries are choosing. The ambition to develop the LNG market has been demonstrated in the strategic development policies of the Government's gas industry as well as in Resolution No55/NQ-BCT in 2020 of the Politburo. However, in reality, the development of Vietnam's LNG market will also face many challenges such as related legal framework, infrastructure and technology, and changing gas prices leading to the competitiveness of LNG with other forms of energy. Therefore, to ensure sustainable development of the LNG market, it is necessary to carefully consider related issues and have policy mechanisms to support investors.

³³ IUG (n 27).